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THE DEVONIAN FISHES OF MISSOURI

BY
E. B. BRANSON
Professor of Geology

UNIVERSITY OF MISSOURI
COLUMBIA, MISSOURI
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Ptyctodus calceolus is the only fish that has previously been reported from the Devonian of Missouri, but recently several other species have come to the writer's attention and they are described in the present paper. Most of these were collected by Mr. R. R. Rowley in the vicinity of Louisiana, but Mr. D. K. Greger has furnished remains of two species from Callaway County, Mr. H. M. Scott one form from near Providence, and the writer has collected a few specimens from Louisiana, Callaway County, and Providence. A few specimens from Louisiana are in the Walker Museum of the University of Chicago and some fragments from the same locality were in the museum of the University of Missouri before the present investigation was started.

Mr. Rowley's collection consists of six species of elasmobranchs, represented by ten specimens, one species of chimæroid, represented by some two hundred specimens, and several species of arthrodires, represented by about one hundred bones and fragments of bones. No two of these bones are known to belong to the same species, but it is probable that some of them belong to the same individual, and in the descriptions given below the bones that seem to belong together are described as representing one species. The groupings may, in some cases, be incorrect, but it seems better to make them, thus expressing the writer's judgment, than to figure all of the bones as unrelated. Of the jaw parts by which arthrodires are usually identified there are two upper dental plates and the back part of two mandibles. The complete or nearly complete bones are three median occipitals, two upper dental plates, one postero-dorso lateral, two pineals, one tooth of *Mylostoma*, and several fin rays.

Mr. Rowley says of the occurrence of these fossils: ''I have found them in the one-foot dark blue shale under the Louisiana or lithographic limestone, from the top of the shale quite to the bottom, but most abundant from the middle to the top. Just under the Louisiana limestone is a thin band of yellow sandy shale, from a fraction of an inch to two and one-half inches thick, well filled with the same fossils as the limestone above. In places, especially where the yellow shale is thin, the fossils extend downward, sometimes two or three inches, thus invading the fish bone horizon.

"Near the bottom of the three and one-half feet of black shale that underlie the blue shale at Louisiana, is a siliceous sandstone band of less than an inch in thickness that yields fragments of teeth and bones and the black objects identified as coprolites. On Grassy Creek, where the blue as well as the black shales increase greatly in thickness, there appears to be more than one band of siliceous sandstone, and the upper band is often two to four inches thick."*

ARTHRODIRA

Dinichthys rowleyi sp. nov.

(Plate I, figs. 1, 2, 4, 5, 6)

This species is based on a left upper dental plate, the posterior end of a mandible, an occipital, external occipital, and dorso-median, all of which are in the collection of Mr. Rowley.

The left upper dental is almost perfectly preserved. Its greatest length is 59 mm., and the greatest width of the cutting blade is 22 mm. The cutting blade is almost straight and 42 mm. long. The tooth has no lateral flange and its surface is smooth. (Fig. 5).

The mandible has only the posterior part preserved. It is 7 cm. wide at the widest part. (Fig. 6).

The occipital is 75 mm. wide at the posterior end, 40 mm. at the anterior end, and 72 mm. in length. The bone is peculiar on account of a strong longitudinal ridge along the entire length of the lower side in the median line. On either side of this ridge there are deep, wide depressions, from each of which rises a round-topped projection like a truncated cone. On the upper surface three shallow depressions distinguish it from described forms. (Fig. 1).

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*Letter from Mr. Rowley, dated Sept. 6, 1912.

The external occipital, like that of *D. intermedius*, projects little behind the occipital, but it is unusual in its very short articulation with that bone. The length of this articulation is shown in the left margin of figure 4. (Fig. 4).

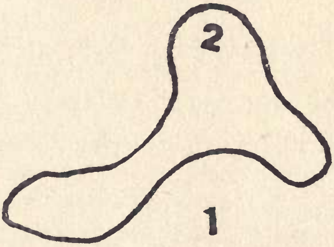
Only a small part of the dorso-median is preserved but its size and association indicate that it belongs to this species. (Fig. 2).

Formation and locality: Near the top of the Devonian at Louisiana, Mo. Collection of Mr. Rowley.

Dinichthys missouriensis sp. nov.

(Plate II, figs. 1, 2, and 4. Plate III, fig. 1)

The lower end of the left upper dental plate is missing. The length preserved is 109 mm. but its total length was at least 160 mm. The greatest width of the cutting blade is 62 mm. The cutting blade is thin but has a prominent rounded ridge 9 mm. high, 20 mm. back of the front edge. The shape of its cross section as shown in text figure 1 distinguishes it from all other described species. (Fig. 1).



Text figure 1. Cross section of left upper dental plate of *Dinichthys missouriensis*. 1, Outer view of tooth; 2, Ridge near front edge.

Only the posterior part of the mandible is preserved. It is 13 cm. wide compared to 7 cm. for *D. rowleyi*, and is proportionately thick. If found in the Cleveland shale of northern

Ohio, it would be referred to *D. intermedius* almost without question. (Plate II, fig. 1).

The external occipital is comparable in size to *D. intermedius* but is quite different in shape. The length of articulation with the occipital is 77 mm. and the shape of the articulating edge is different from that of any of the large dinichthyids that have been described. A peculiarity is a shallow elongated depression near the left margin. (Plate II, fig. 2).

Only a small part of the dorso-median is preserved. Its thickness near the base is 5 cm. and the width of the posterior prong is 3 cm. It is peculiar in having a deep pit on either side of the median line 65 mm. in front of the back margin. These pits have been retouched in the photograph but show no more prominently than in the specimen. The writer knows of no other dinichthyid having the same peculiarity. (Plate II, fig. 4.)

The bones described above belong to a species about the size of *D. intermedius*, but each, with the exception of the mandible, has peculiarities that distinguish it from that species. As noted before it is not known that the bones belong together.

Formation and locality: Near the top of the Devonian at Louisiana, Mo. Collection of Mr. Rowley.

Mylostoma eastmani sp. nov.

(Plate II, fig. 3)

Mr. Rowley has collected only one tooth of *Mylosto ma* It is larger than *Mylostoma variablis* and differs from that species in shape and structure. The latter is indicated in surface markings which are shown in the photograph. The shape is similar to that of the shear teeth of some species of *Dinichthys*, but the tooth is of nearly uniform thickness, shows wear all over the figured surface, and the peculiar pores run at right angles to that surface. The greatest length of the element is 9 cm., and the distance from the tip of the slender prong to the opposite side 52 mm.

Formation and locality: Top of the Devonian at Louisiana, Mo. Collection of Mr. Rowley.

Isolated bones from the Upper Devonian at Louisiana, not identified with any species. Collection of Mr. Rowley.

External Occipital of *Dinichthys*: (Plate III, fig. 5.) This bone differs from that of *D. rowleyi* in being smaller, having a less prominent prong, a shallower socket, and in widening toward the front instead of being widest at the back.

Occipital of *Dinichthys*: (Plate I, fig. 3.) This bone is slightly larger than the occipital of *D. rowleyi*, the upper surface is smooth, and the lower surface is marked by a deep depression in the middle near the back end. It is wider than *D. rowleyi* in proportion to its length.

Fin Rays of *Dinichthys*: (Plate III, figs. 2 and 6.) The ray shown in figure two is oval in cross section, 15 mm. in longer diameter and 12 mm. in shorter diameter at the larger end. The ray shown in figure 6 is preserved almost entire.

Postero-Dorso-Lateral of *Dinichthys*: This bone is 15 cm. long along the outer edge and its greatest width is 8 cm. It seems to present no peculiarities worthy of note and the writer was not able to place it with any species.

Several fragments probably belong to *Titanichthys* though they are massive for that genus. The most complete bone is shown in plate III, figure 7. The figure is about two-thirds natural size.

CHIMAEROIDEI

Ptyctodus ferox Eastman

(Plate IV, figs. 3 and 4)

1898. *Ptyctodus ferox* Eastman, Amer. Nat., 32, p. 480, text-figs. 35-40.
1899. *Ptyctodus ferox* Eastman, Jour. Geol., 7, p. 282.
1906. *Ptyctodus sp.* Dean, Carnegie Inst. Wash., Pub. no. 32, p. 139, text-fig. 126.
1907. *Ptyctodus ferox* Eastman, Mem. N. Y. State Mus., 10, p. 72.
1908. *Ptyctodus ferox* Eastman, Ia. Geol. Surv., 18, pp. 135-137, text-figs. 20-22.

One specimen of this species, collected by Mr. D. K. Greger three feet from the top of the Craghead Creek shales of Callaway County, Missouri, is in the University collection. The specimen is less than half as long as the type but seems to belong to the same species. It will be noted by referring to figure 3 of plate IV of this paper and Eastman's figures in the American Naturalist and the Iowa report that the tooth under discussion seems to be much broader in the middle but it is possible that part of Eastman's specimen is missing. Eastman does not describe the tritoral part of the upper tooth. In the present specimen it extends nearly the entire length, is narrow, and the parallel rows of punctations, so conspicuous in *P. calceolus*, occur only at the hinder part. The tritor is 34 mm. long, 8 mm. wide at the base at one end and narrowing to 2.5 mm. at the other. At the top it is 5 mm. wide at the hinder end and thins to a point at the front end.

Ptyctodus calceolus Newb. and Worthen

(Plate III, figs. 3, 4)

Ptyctodus calceolus is by far the most abundant form occurring in the Missouri Devonian. Mr. Rowley has more than two hundred teeth in his collection and the writer collected eight fair tritors and six or seven poor ones in about an hour's work on the formation near Louisiana. The writer has collected a number of these teeth from a Kinderhookian sandstone just below the Chouteau near Providence, Missouri, and from the same sandstone near Fulton, Missouri, and numerous localities in Montgomery and Warren Counties, Missouri. The Phelps sandstone of southwestern Missouri contains them in abundance. In another paragraph a brief note on the stratigraphy of the Devonian of Missouri is given and it is stated as the opinion of the writer that the teeth were derived from the erosion of the Devonian shales that contained them. The teeth found at Louisiana are often in good condition and show little wear, but those found at Providence and elsewhere in the Kinderhookian sandstone are greatly worn, rarely more than half a tooth being found. While collecting at Louisiana, the writer found one of these teeth on the surface of the lower layer of the Louisiana limestone, but Mr. Rowley insisted that it must have come from the near lying shales that had been disturbed while the street was being graded and said that he had never seen one of the teeth in the Louisiana, though he has collected from it for forty years. The green sandstone that contains the teeth at Providence overlies the Devonian with decided unconformity. It seems that the Phelps sandstone, the conglomerate and sandstone at Fulton, the green sandstone at Providence and the red sandstones of Warren and Montgomery Counties represent the first deposits in an advancing sea and contain the fish teeth as part of the worked over regolith. A Devonian shale was once present near Providence as is shown by a remnant of it described in another place in this paper.

CTENODIPTERINI

Dipterus digitatus Eastman

(Plate IV, figure 21)

1907. Palatal dental plate of undescribed dipterine species' C.R. Eastman, Mem. N. Y. State Mus., 10, p. 202, pl. 4, fig. 8.

1908. *Dipterus digitatus* Eastman, Devonian Fishes of Iowa, Ia. Geol. Surv., XVIII, pp. 221-222, pl. VII, figs. 16-25.

One specimen of this species from near Providence, Missouri, is in the collection of the University of Missouri. It was collected from the green sandstone at the base of the Chouteau but was probably derived from the erosion of the Devonian shales below.

Conchodus variablis Eastman

(Plate III, fig. 8)

1908. *Conchodus variablis* Eastman, Ann. Rept. Iowa Geol. Surv., XVIII, pp. 230-231, plates IX and XI.

One specimen of this species has been found in the shales near Louisiana. The writer sent a photograph of the specimen to Dr. Eastman, who identified it with his species.

Formation and locality: Upper Devonian, Louisiana, Mo., and Johnson County, Iowa. Collection of Mr. Rowley.

ELASMOBRANCHI

Some of the earliest of the pavement toothed sharks appear in the shales near Louisiana and are represented by six species. Most of the teeth are small, but one is unusually large for an *Helodus*. In the Chouteau at Sedalia, Missouri, *Helodus* teeth only slightly different from those of the Devonian occur. The Devonian teeth are simple and without crenulations or surface markings, but the Chouteau teeth have inconspicuous surface markings on most of them. The Chouteau specimens show the beginning of the union of the helodont forms to form the large cochliodont teeth that soon after became abundant. Mr. Rowley has only ten of the elasmobranch teeth in his collection and their rarity in the Devonian may be judged from this.

Helodus rowleyi sp. nov.

(Plate IV, figs. 25 and 26)

This species is present above the usual fish bearing horizon at Louisiana. The tooth is 48 mm. long and 21 mm. wide. The root is 12 mm. high and 16 mm. wide and projects backward. The vertical front edge of the crown is crenulate to near the summit and the sloping, back margin is crenulate to near the middle of the tooth. A low, broad, rounded boss projects slightly upward a little to one side of the middle. The specimen does not closely resemble any other described *Helodus*.

Collection of Mr. Rowley.

Helodus devonicus sp. nov.

(Plate IV, figs. 19, 20)

Type a single specimen in the collection of Mr. R. R. Rowley. Length of tooth 18 mm., breadth at widest part 6 mm., height of crown 3 mm. The crown narrows gradually from the middle to the ends and is highest in the middle though the elevation is not localized into a cone. The outer ends of the tooth curve slightly backward. The crown is closely and finely punctate.

Horizon and locality: Near the top of the Devonian shale at Louisiana, Missouri.

Helodus incipiens sp. nov.

(Plate IV, figs. 11-16)

Types four teeth in Mr. Rowley's collection. Teeth small and simple, gently arched toward the top but without median cone. Sides subparallel. No crenulations or ornamentations of any kind are present on the crown. One tooth shows transverse corrugations across the base of the root. Root generally missing. These teeth show some variation in shape and size but are generalized and of a type that may have given rise to all of the early Mississippian helodonts. If the shales from which they were collected are Devonian in age these are among the oldest of the pavement toothed sharks known from America. In the Chouteau of Sedalia and Providence, Missouri, three or four species occur that may be distinguished from the Devonian teeth by minor characters only and seem to be direct descendants of the Devonian forms.

Horizon and locality: Near the top of the Devonian shales at Louisiana, Missouri.

Helodus clivulus sp. nov.

(Plate IV, figs. 1, 2, 5, 6)

Types two incomplete teeth. These teeth are not far removed from *Helodus incipiens* but have a low median boss instead of the curving surface of that species. The crown part at the ends is thinner than in that species and the punctation seems to be different, though it is impossible to determine this positively without sectioning the teeth.

Horizon and locality: Near the top of the Devonian shales at Louisiana, Missouri. Collection of Mr. Rowley.

Eoorodus typus gen. et. sp. nov.

(Plate IV, figs. 22-24)

Type one tooth with part of one end missing. The incomplete tooth is two centimeters long. The length from the middle to the end of the perfect part is 14.5 mm. The greatest width is 12 mm. at the middle of the tooth from where it tapers gradually to a width of 5 mm. and thence abruptly to a sharp point. The greatest height of the crown, 11.5 mm., is at the summit of the median cone which occupies the entire width of the tooth and more than half of the length. The cone is low and smooth save for a few crenulations around the base. The top of the tooth outside the cone has many small irregular crenulations that run from the edge toward the middle. The surface of the tooth is not punctate. The root is missing and was probably cartilaginous.

The form was probably ancestral to *Orodus*. Surface ornamentation of the *Orodus* type is developing and a median cone, similar to the one in that form but larger in proportion to the rest of the tooth, is present.

Formation and locality: Top of the Devonian shales at Louisiana, Mo. Collection of Mr. Rowley.

Psephodus sp. undet.

(Plate IV, fig. 18)

One imperfect tooth from the Devonian at Louisiana seems to belong to this genus, though it has not crenulated margins. In shape it is similar to *Psephodus obliquus* of St. John and Worthen from the Kinderhook of Iowa. The writer photographed and studied the tooth but has not been able to compare it directly with other *Psephodus* teeth, as the owner did not care to have it taken from Louisiana.

Collection of Mr. Rowley.

DEVONIAN STRATIGRAPHY

Mr. R. R. Rowley has worked out the Devonian stratigraphy in Pike County.* At Louisiana it consists of four feet of dark colored shales and is conformably overlain by the Louisiana limestone of the Mississippian. Eight miles west of Louisiana it has thickened to sixty feet or more of shales, and a few miles to the southeast a limestone, called Hamilton by Rowley, wedges in under the shales.

Mr. D. K. Greger has kindly furnished the writer the following section from near Fulton, Missouri:

> "The Devonian of Callaway County has a thickness of approximately eighty feet and consists of dark, thin bedded, ironstained limestones at the base becoming somewhat argillaceous upward and terminating in very fine grained shales. Dr. Keyes has applied the name Callaway limestone to the lower beds and the writer has named the upper part, which contains no limestone and is separated from the lower by an unconformity, the Craghead Creek shales. The Callaway limestone is best exposed on Rock House branch south east of Fulton and consists of forty-two feet of thin bedded limestone followed by nine feet of argillaceous concretionary limestone containing pyrite crystals. Above the unconformity the Craghead Creek formation begins as dark blue or drab sandy shales with thin calcareous partings becoming lighter in color upward and terminating in soft yellow or gray siliceous shales. The thickness is approximately twenty-five feet."

The Craghead Creek shales contain *Ptyctodus calceolus* teeth and so do the shales at Louisiana but the invertebrate faunas are entirely distinct. Greger's list from the Craghead Creek shales contains four corals, four crinoids, twenty-five brachiopods without a *Lingula*, six pelecypods, two cephalopods, and one bryozoan.† Lingulas make up most of the fauna of the shales at Louisiana, a *Stropheodonta* has been reported, and a few pelecypods occur. The Lingulas are abundant in some horizons and some are very large. The question of the correlation of these shales arises, but the data at hand are insufficient for drawing conclusions. The Craghead Creek shales are to be correlated with the upper part of the Devonian of Iowa, but whether the shales at Louisiana are merely a near shore phase of them or belong to a higher formation, or were separated from them by a barrier while they were forming remains to be investigated. The invertebrate fauna suggests the former as a possibility but arthrodires occur in the Louisiana region and have never been found in the Craghead Creek shales. As they swam freely and were not restricted by shallow or deep water, they should occur in both faunas, if they are contemporaneous and not separated by a barrier.

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*Mo. Bu. Geol. Min., III. 2d series, pp. 24-26.

†Amer. Journ. Sci., XXVII, pp. 376, 377.

Twenty miles west of Fulton the Devonian consists of a limestone twelve to twenty feet in thickness, which is not abundantly fossiliferous, and in which the main forms present are corals and *Pleurotomaria providencis*, which also occurs in the Callaway limestone near Fulton. This limestone appears along the bluffs of the Missouri river and the exposures are good on account of railway excavations. The exposure is seven or eight miles long, running from Providence to near Hartsburg. About two miles below Providence another Devonian limestone wedges in unconformably on top of the first but is present for only three or four hundred feet. It is abundantly fossiliferous but as the fossils are mainly *Atrypa reticularis* the data are insufficient for correlation. The bed seems to correspond to one of the *Atrypa reticularis* horizons of the Callaway limestone twenty miles east. The limestone ranges from one inch to four feet in thickness. At the same place a shale that runs for more than one thousand feet wedges in unconformably on top of both limestones. It is less than four feet in thickness and occurs at only the one place in the exposures along the river. In most cases both the top and the bottom of the Devonian are exposed along the bluffs and the absence of the second limestone and the overlying shale is demonstrated. The shale is probably nonmarine, as it contains great numbers of fragments of plants and no other fossils.

These beds have not been named or correlated further then Ulrich's reference to Middle and Upper Devonian of beds of a similar nature that occur in the bluffs on the other side of the river. This reference seems to have been made from a field examination of the fossils.*

In the Providence region a green sandstone two to eight inches in thickness overlies the Devonian unconformably and underlies the Chouteau with apparent conformity. It has been called the fish bed on account of the large number of fragments of teeth of *Ptyctodus calceolus* that occur in it. Near Fulton this sandstone gives place to a conglomerate that also bears fish teeth in abundance, and in Warren and Montgomery counties a red sandstone, usually one to five feet in thickness but ranging up to sixty feet, occurs at the same horizon and carries *Ptyctodus calceolus* teeth. Besides *Ptyctodus calceolus*, *Dipterus digitatus* Eastman is found near Providence.

The sandstone probably corresponds to the Phelps sandstone of southern Missouri which, according to Weller, probably represents the first deposits in the advancing Mississippian sea. There is an abrupt change from the sandstone to the limestone above, but there was no erosion between. It seems probable to the writer that the fish remains were derived from the erosion of the underlying shale and that the fishes did not live in the sea in which the sandstone was deposited. Their remains should be found in the overlying limestone if they lived in the sea, and the remains found in the sandstone are always greatly worn.

The arthrodires in the fauna of the shales of Louisiana are valuable in fixing the upper limit of the Devonian. The Louisiana limestone of northeastern Missouri is generally conceded as belonging to the lower part of the Mississippian, and Mr. Rowley has thought that the underlying shales should be classed with the limestone. The arthrodire remains occur to within an inch of the Louisiana, but no trace of them has ever been found in the limestone. In Ohio the arthrodires occur to the bottom of the Bedford shale, but none of them has been found in the Berea above the Bedford. They will probably prove of more value than the invertebrates in determining the upper limit of the Devonian in Ohio, if stratigraphic

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*Missouri Bureau of Geology and Mines, 2d series, Vol. III, p. 41.

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evidence is neglected and the entire basis made paleontologic. At no place have arthrodire remains been found in rocks of recognized Mississippian age. It would of course be rash to say that they do not occur above the Devonian, but until they are shown to have passed into the Mississippian they remain good indices of the Devonian.

The writer is glad to express his obligations to Mr. R. R. Rowley who kindly allowed his collection to be studied, and to Mr. D. K. Greger and Mr. H. M. Scott who donated specimens to the University of Missouri collection.

EXPLANATION OF PLATES

Plate I

Figs. 1, 2, 4, 5, 6. *Dinichthys rowleyi* sp. nov.
1. Under side of occipital, about 5-7 natural size.
2. Top of dorso-median, about 5-7 natural size.
4. Top of external occipital, about 5-7 natural size.
5. Vomerine tooth, about 2-3 natural size.
6. Fragment of mandible, about 5-7 natural size.

All of these bones are from the upper part of the Devonian at Louisiana, Mo. Page 60-61.

Fig. 3. Occipital of unidentified *Dinichthys*. (5-7.) Top of the Devonian at Louisiana, Mo. Page 63.

Plate II

Figs. 1, 2, 4. *Dinichthys missouriensis* sp. nov.
1. Posterior end of mandible, about 2-3 natural size.
2. External occipital, about 5-8 natural size.
4. Much worn dorso-median, about 2-3 natural size.

All of these bones are from the upper part of the Devonian at Louisiana, Mo. Page 61-62.

Fig. 3. *Mylostoma eastmani* sp. nov. Top view of type specimen, about 5-7 natural size. Top of the Devonian at Louisiana, Mo. Page 62.

Plate III

Fig. 1. *Dinichthys rowleyi* sp. nov. Incomplete left vomerine tooth, about 2-3 natural size. Page 60.

Figs. 2 and 6. Fin rays of a dinichthyid, about 2-3 natural size. Page 63.

Figs. 3 and 4. Tritors of *Ptyctodus calceolus* Newb. and Worthen, about 2-3 natural size. Page 64-65.

Fig. 5. Under side of an external occipital of *Dinichthys* about 2-3 natural size. Page 63.

Fig. 7. Unidentified bone of an arthrodire, about 2-3 natural size. Page 63.

Fig. 8. Dental plate of *Conchodus variablis* Eastman, about 2-3 natural size. Page 65-66.

All of the specimens figured on this plate are from the top of the Devonian at Louisiana, Mo.

Plate IV

Figs. 1, 2, 5, 6. *Helodus clivulus* sp. nov. Figs. 1 and 2 top and side views of an almost complete tooth. Figs. 5 and 6 top and side views of a smaller incomplete tooth. From the top of the Devonian at Louisiana, Mo. Page 67.

Figs. 3 and 4. *Ptyctodus ferox* Eastman. Side and top views of a specimen from the Craghead Creek shales of Callaway County, Mo. Page 63-64.

Figs. 7-10 and 17. Specimens of *Helodus* from the Chouteau limestone of Sedalia, Missouri. Fig. 7 shows the union of two teeth to form one. Page 66.

Figs. 11-16. *Helodus incipiens* sp. nov. Top and side views of the four cotypes. Fig. 12 is a side view of the specimen shown in fig. 11, and fig. 15 is a side view of 13. Top of the Devonian at Louisiana, Mo. Page 67.

Fig. 18, *Psephodus* sp. undet. Top view of a specimen from the top of the Devonian at Louisiana, Mo. Page 68.

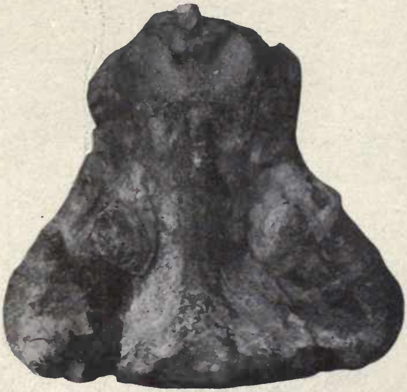
Figs. 19 and 20. *Helodus devonicus* sp. nov. Side and top views of the type. Top of the Devonian. Louisiana, Mo. Page 66-67.

Fig. 21. *Conchodus variablis* Eastman, From a six inch bed of green sandstone at the base of the Chouteau limestone, Providence, Mo. Page 65-66.

Figs. 22-24. *Eoorodus typus* gen. et. sp. nov. Top of the Devonian at Louisiana, Mo. Page 68.

Figs. 25 and 26. *Helodus rowleyi* sp. nov. Top of the Devonian at Louisiana, Mo. Page 66.

PLATE I



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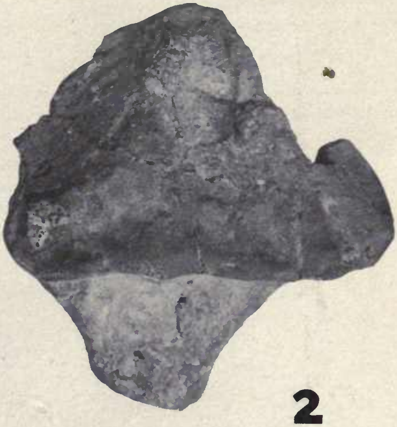

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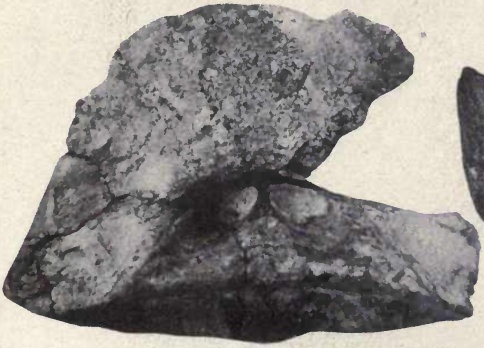

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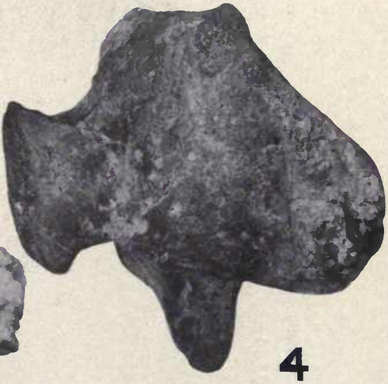

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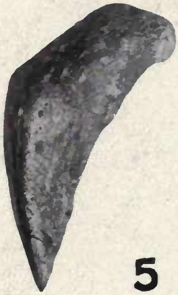

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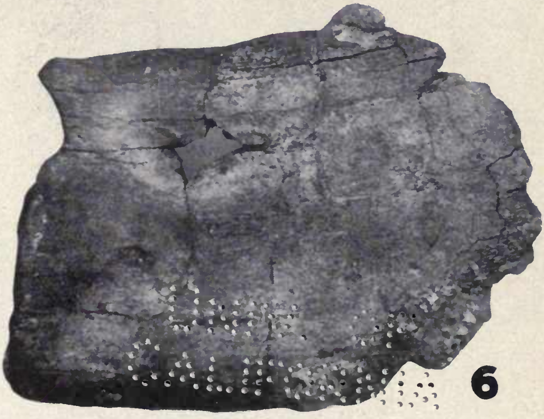

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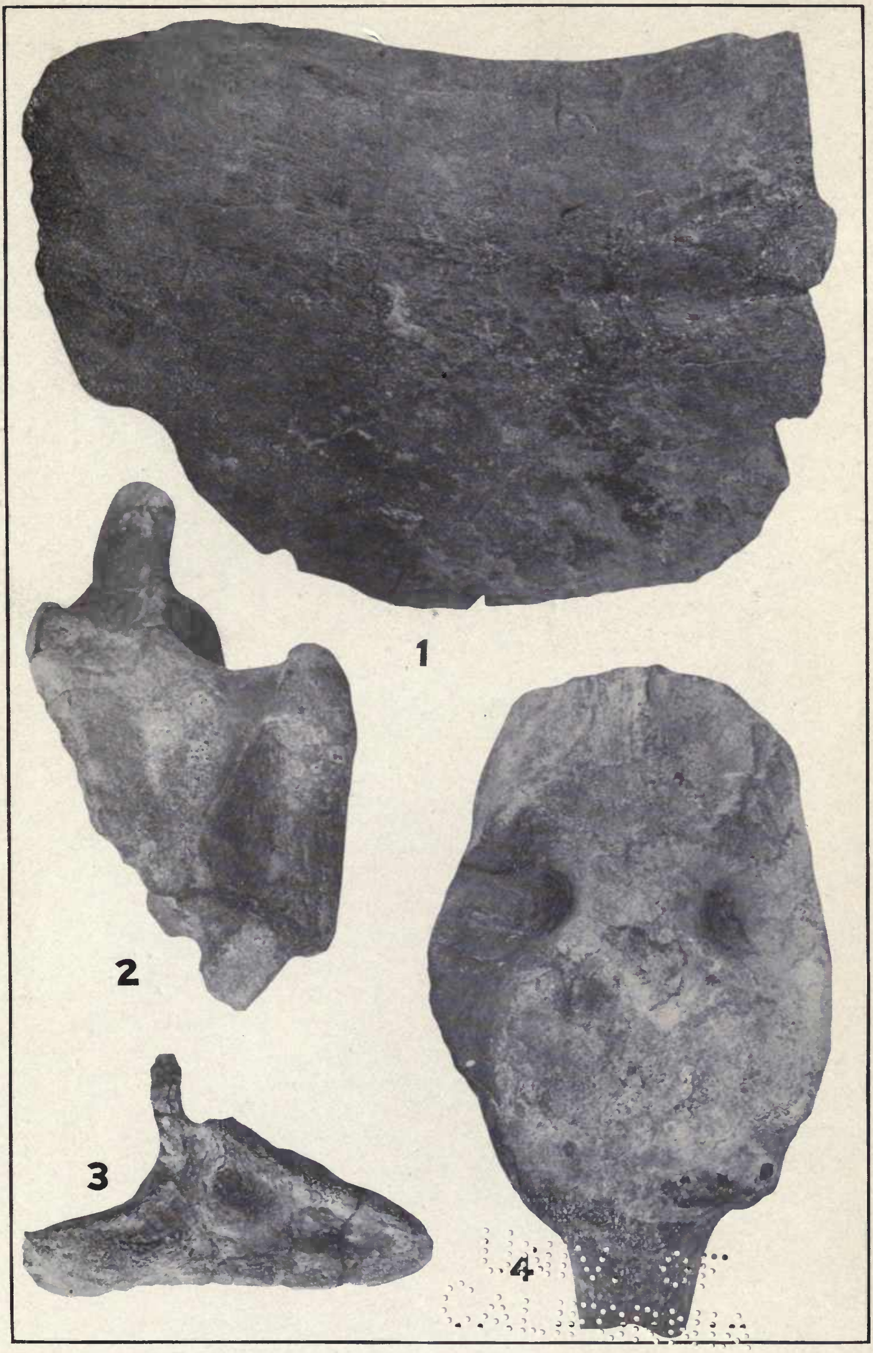

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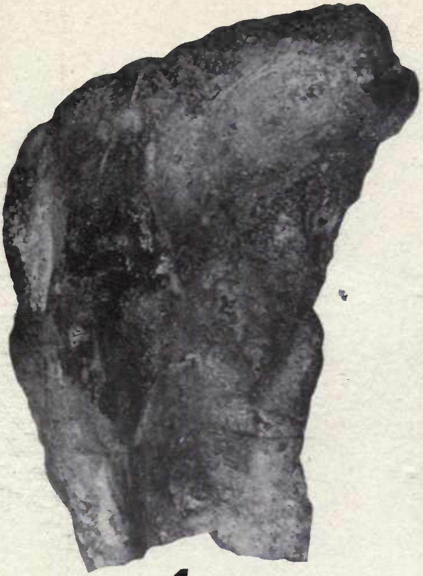

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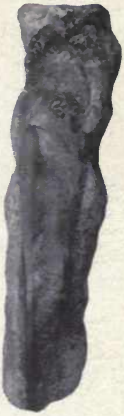

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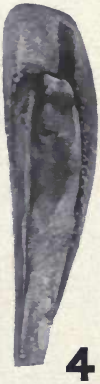

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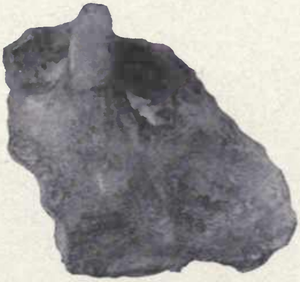

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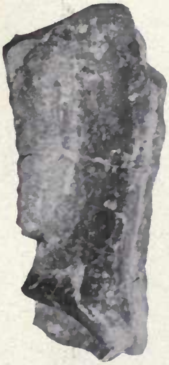

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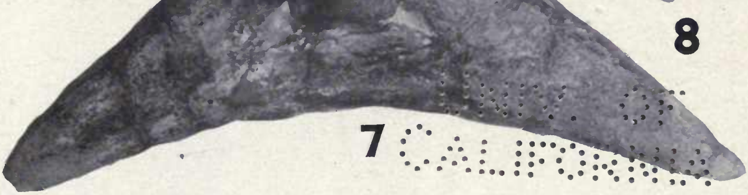

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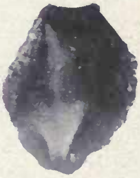

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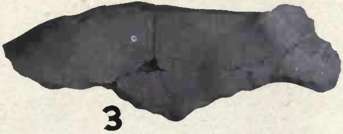
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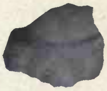
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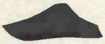
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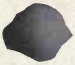
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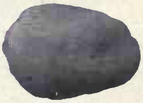
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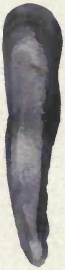
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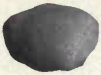
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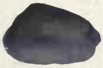
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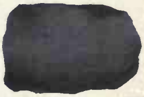
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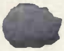
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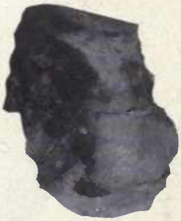
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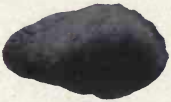
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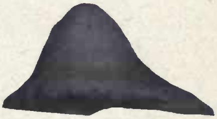
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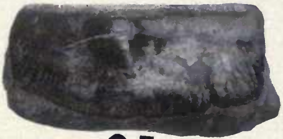
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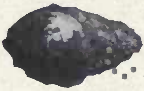
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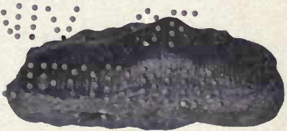
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